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INCENTIVES FOR ACHIEVING COMPONENT STANDARDIZATION IN SHIP CONSTRUCTION

Logistics Management Institute
Washington, D.C.

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TASK 67-18

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**INCENTIVES FOR ACHIEVING COMPONENT
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I. INTRODUCTION

A. BACKGROUND

During 1966 and 1967 the Navy, as a part of its effort to achieve equipment standardization in new ship construction, developed a general Equipment Standardization Incentive Clause for new construction contracts. That Clause, with slight modifications, was incorporated into seven contracts for ship construction.

The objective of the Equipment Standardization Incentive Clause, as stated in the seven contracts, is:

" . . . to increase maintainability of shipboard equipment and reduce cost of logistic support by encouraging installation in the vessel of equipments identical to those already installed in U. S. Navy ships and for which Allowance Parts Lists (APL) have already been prepared or are pending . . . "

The incentive clause provides for an increase in the contract price if at least 90% of the contractor-furnished equipments comprising each of several selected categories are supported by existing or pending Allowance Parts Lists (APLs). Each contract identifies the equipment categories to which the incentive clause applies.¹ The amount of the incentive is determined by the lowest percent of APL-supported equipment attained in any of the categories included in the incentive clause, with no incentive payment made if any category falls below the 90% mark. The amount of the

¹ Appendix A is a typical "Equipment Standardization Incentive Clause" included in the LST 1182-1198 contract, and identifies the equipment categories to which the incentive applies in this particular contract.

incentive increases only when the lowest per cent by category increases.

The seven contracts in which the Equipment Standardization Incentive Clause was incorporated account for a total of 46 new ships at the approximate contract price of \$715 million. The number of ships per contract ranges from one to twenty. Table 1, page 3, shows selected data pertinent to each contract.

B. OBJECTIVES OF THE STUDY

In May of 1967 the Director of Standardization and Configuration Management, NAVMAT, requested the Logistics Management Institute to study the Navy's Standardization Incentive Clauses. The study has three principal objectives:

- 1) To appraise the effectiveness of the present incentive clauses toward achievement of improved standardization of Hull Mechanical/Electrical equipment;
- 2) To develop, if feasible, uniform criteria for establishing the amount of monetary incentive required to motivate shipbuilders to standardize on ship components in the overall best interest of the Government; and
- 3) To develop recommendations for useful modifications to the presently used incentive clauses which will provide improved overall benefits.

The objectives implicitly require that consideration be given to the economic benefits of equipment standardization to the Navy in determining the amount of incentive which should be offered to achieve such benefits. Thus, LMI was concerned with finding the answers to three primary questions: (1) What degree of equipment standardization would likely be achieved without an

TABLE 1
CONTRACTS FOR SHIP CONSTRUCTION CONTAINING
STANDARDIZATION INCENTIVES

Type Ships	No. Ships	Contract Awarded Mo./Yr	Min/Max Incentive Amount	Contract Price (Millions)	Contractor	Estimated Completion Date of 1st ship in Contract
AS-37	1	4/66	\$100K/200K	\$ 37.4	General Dynamics --Quincy	3/69
AOR 3-4	2	7/66	100K/200K/Contract	53.8	General Dynamics --Quincy	7/69
SSN 673-76	4	7/66	100K/200K/Ship	111.5	Electric Boat Div.	12/69
LST 1182-98	17	7/66	10K/20K/Ship	249.1	National Steel	5/69
DE 1078-97	20	8/66	100K/200K/Contract	217.7	Avondale	6/70
AKA-117	1	8/66	50K/100K	22.0	Newport News	6/69
LSD-40	1	5/67	100K/200K	23.8	General Dynamics --Quincy	9/69
46 Ships				\$715.3		

incentive clause; (2) what would it cost the contractor or the Navy to increase the degree of equipment standardization normally achieved; and (3) what is the economic value to the Navy of increased equipment standardization. LMI's effort included discussions with knowledgeable personnel from both the Navy and the shipbuilding industry. Our discussions with contractor personnel were generally with management executives responsible for procurement and engineering who are associated with 45 of the 46 ships covered by the seven contracts.

Our findings and analysis are contained in Section II of the report and are presented in three major parts. Part A deals specifically with the present standardization incentive clauses and includes an appraisal of their contribution. Part B presents a conceptual analysis of the purpose, requirements, and various methods of contracting for equipment standardization. Uniform criteria for use in determining the amount of incentive required to motivate the contractor to achieve increased equipment standardization is also discussed. Part C of the report outlines a proposed standardization plan designed to motivate the contractor to achieve maximum feasible equipment standardization within the best economic interest of the Navy.

II. FINDINGS AND ANALYSIS

A. PRESENT STANDARDIZATION INCENTIVE CLAUSES

1. Description of Present Clauses

The Equipment Standardization Incentive Clauses included in the seven new construction contracts are quite similar. All have the same general format, as follows:

Sect. (a) - Statement of Objectives.

Sect. (b) - Minimum Component Commonality Required and Identification of Equipment Categories Covered.

Sect. (c) - Amount of Incentive and Method of Computation

Sect. (d) - Value Engineering Waiver.

Sect. (e), (f), or (g) - The remaining sections of the clause indicate specific equipments which are excluded, where appropriate. The last section of each clause states that the "incentive clause in no way relieves the contractor from fully complying with the requirements of the specifications."

The Equipment Standardization Incentive Clause contained in Amendment No. 3 of P. R. 529-61403 for the LST 1182-1198 Contract is included as Appendix A. The clause is typical of the seven clauses examined; the only significant difference among them is the dollar amount of the incentive. The equipment categories included in each of the clauses vary slightly, principally because of the differing characteristics of the ships being procured. In each case, the categories of equipment covered include almost

all contractor-furnished equipment that requires repair parts support.

2. Analysis of Present Clauses

a. Objectives. The primary objective of the clauses is to achieve intra-Navy standardization. They provide a monetary reward to the shipbuilder commensurate with his success, during new construction, in using equipments already supported in the Navy by APLs that were in effect or pending on 1 January 1966. An "APL in effect or pending on 1 January 1966 is defined as one resulting from a shipbuilder, subcontractor, or Government purchase order for the item placed before 1 January 1966."¹

It is important to understand that the objective of the clauses is limited to intra-Navy standardization. They do not promote intra-class, intra-contract, or intra-ship standardization. Moreover, they emphasize the general re-use of any equipments supported prior to 1 January 1966; no attempt is made to motivate the contractor to select the higher quality or most economical item from among the presently supported equipments. Thus the present clauses have the limited objective of achieving economy with respect to Navy supply management costs² rather than total life costs. The clauses do, however, provide an opportunity for the contractor to use an equipment not supported by the Navy if it offers "an order of magnitude technical advantage over an

¹ BUSHIPS letter 4281, Ser. 640B-48 of 11 April 1966 to SPCC MECH (Copy to ALL SUPSHIPS).

² Navy Supply Management Costs as used in this report means those costs within the Navy Supply System down to and including the Naval Supply Center level which are incident to procuring, stocking, and issuing replacement items (either end item equipments or repair parts) and includes initial cataloging, inventory management, reprocurement administration, receiving, storage, and parts requisitioning.

item supported by an APL." In such cases the contractor is encouraged to submit a value engineering change proposal, and if accepted the non-supported equipment proposed by the shipbuilder is counted as an item supported by an APL. This provision is included in paragraph (d) of all seven standardization incentive clauses and will be examined in greater detail later in the report.

Although an incentive arrangement which tends to reduce only Navy Supply Management costs may be incomplete insofar as overall standardization objectives are concerned, there are advantages in using this type of incentive. It is much easier for the shipbuilder to respond to this type of incentive; it is much easier for the Navy to evaluate the limited economic advantage of standardization and thus establish an incentive rate; and an incentive program based only on the number of equipments already supported is easier for both the shipbuilder and the Navy to administer.

b. Minimum Component Commonality. All seven incentive clauses require that at least 90% of the contractor-furnished equipments in each of several categories must be supported by APLs in effect or pending in order to qualify for any amount of the standardization incentive. This requirement does not appear to be in the best interest of either the Navy or the contractor, for two reasons.

First, the 90% minimum commonality does not necessarily reflect the degree of standardization that would be achieved in each case without the incentive clause, and hence does not provide an appropriate base from which to measure the contractor's effort to achieve standardization or the value of such achievement to the Navy. The 90% figure is applied to each equipment category in all seven contracts and thus suggests that 90% represents a norm or average. If an average figure is to be applied, 90% is probably high. The Ships Parts Control Center (SPCC), Mechanicsburg,

Pennsylvania, has stated that "approximately 70 to 75 percent of HM&E equipments in new construction ships are covered by existing APLs."¹

The degree of standardization that likely would be achieved without an incentive clause will undoubtedly vary from contract to contract. A different result might reasonably be expected for each of the following situations:

- (1) Ships that are first in a class.
- (2) Ships where the contractor had not built any of the earlier ships of the class.
- (3) Ships where the contractor had previously built ships of the same class.

LMI did not attempt to develop a statistical norm for each of the above situations. Such norms could be developed, we believe, by the Ships Parts Control Center.

It should be stated at this point that six of the seven contracts with standardization incentive clauses were awarded to contractors who are already building ships of the same class. The exception is the contract for the LST 1182-1198 class awarded to National Steel and Shipbuilding Co. In those cases where a contractor has a previous contract to build ships of essentially the same class, the degree of commonality between equipments installed on ships built under the first contract and those built under the second contract appears to be higher when the time between the contract awards is shorter. For instance, General Dynamics, Quincy, hopes to achieve 95% to 100% commonality between the

¹Capt. Carl B. Ihli, USNR, (Ships Parts Control Center, Mechanicsburg), "Spare Parts, A Fleet Support Dilemma," Naval Engineers Journal, June 1967, page 422.

AOR3-4 and the AOR1-2, the AS37 and the AS36, and the LSD40 and the LSD37-39. In each case the time between previous contract and follow ships contract was approximately one year or less. On the other hand, Avondale Shipyard estimates about 65% commonality between the DE1078-97 and the seven ships which they are building in the DE1052-77 class. In this case the time between contract awards was slightly over two years. The principal reason for greater commonality when the time between contract awards is short is the contractor's ability to place larger purchase orders and thus enjoy greater economic benefits in the acquisition price of equipments. The longer the time between contract awards, however, the more likely it is that such economic advantages will disappear.

The second reason that the minimum commonality requirement may not be in the best interest of either the Navy or the contractor lies in the fact that it is applied to each individual equipment category and the category with the lowest percentage determines the amount of the incentive payment. This does not appear meaningful in terms of measuring the economic advantage to the Navy of standardization. The best way to illustrate the point is to assume an example where in a single category of equipment there are only five different equipments used in a ship. If the shipbuilder for some reason decided to use a non-standard equipment to meet one of the five requirements, he would fail to meet the minimum of 90% in that category and thus would not earn any of the incentive fee even though he might achieve 100% standardization in all other equipment categories.

The Navy has recognized the problems associated with the present minimum commonality requirements and has adopted a policy of flexibility. All Supervisors of Shipbuilding have been advised that:

"If a contractor is applying due effort to implementing the standardization incentive clause but establishes that 90% identicity of a category in the Category List is impractical of achievement because of a unique requirement in the Ship Specification, or a specification referenced therein, the proposed departure from the clause shall be forwarded to the Naval Ship Systems Command for determination and for change under the contract when appropriate."¹

c. Amount of Incentive. The minimum amount of incentive achievable under each contract varies from \$50K to \$400K. (See Table 1, page 3.) Since the number of ships included in each contract ranges from 1 to 20, it is also interesting to note that the minimum amount of incentive per ship achievable under each contract ranges from \$5K per ship for the DE1078-97 to \$100K per ship for the AS37, SSN673-76, and LSD40. Perhaps even more significant, however, is to compare the amount of standardization incentive achievable under each contract with the amount of profit each contractor might reasonably be expected to earn. For comparison purposes assume that each contractor's anticipated profit is equal to 10% of the contract price. Based on this assumption, Table 2 indicates for each contract the percent increase in profit the contractor might be expected to earn under the standardization incentive clause. It will be noted that the percent increase is generally small and inconsistent among the several contracts.

With regard to the amount of incentive necessary to provide sufficient motivation, it is appropriate to examine the economic tradeoff from the contractor's point of view. The contractor has a rather simple tradeoff to make--that is, his savings, if any, if he selects a non-supported equipment over a supported one

¹ NAVSHIPS letter 4281, Ser. 6640B-121 of 23 September 1966, subject: "SSN673-676, AS37, AOR3 and 4, LST1182-1198, DE1078-1097, LPD16, and AK117--Standardization Incentive Clause, to SPCC Mech. and All Sup. Ships, paragraph d.

TABLE 2

**ESTIMATED INCREASE IN CONTRACTOR'S PROFIT DUE
TO STANDARDIZATION INCENTIVE**

(Assuming each contractor's anticipated
profit is 10% of contract price)

Ship Contracts	Contractor's Profit As a % of Contract Price		
	Without Standardization Incentive	With Standardization Incentives	
		Minimum	Maximum
DE 1078-97	10.00	10.05	10.10
LST 1182-98	10.00	10.07	10.14
AOR 3-4	10.00	10.19	10.38
AKA 117	10.00	10.23	10.46
AS-37	10.00	10.27	10.54
SSN 673-676	10.00	10.36	10.72
LSD-40	10.00	10.42	10.84

vs. the incentive fee he stands to gain if he selects the APL-supported equipment. The contractor's savings lie primarily in the difference between the acquisition price of the supported and non-supported equipment. In considering the acquisition price of a non-supported equipment, the contractor must and does consider the cost of technical documentation and component qualification testing if required. Even with these additional costs the contractor sometimes finds that the acquisition price of a non-APL supported item is appreciably less than an equivalent item currently supported. It is not unlikely, in fact, that the contractor could save an amount greater than the entire incentive by selecting one non-APL supported equipment. This is particularly so in those cases where the contract is for a large number of ships such as the 17 LSTs or the 20 DEs. In fact, one such example was called to our attention by the shipbuilder with the LST 1182-98 contract. In this case the shipbuilder would have had to spend over \$1M more if he procured the engines already APL-supported and selected for the LST 1179. This "savings" far exceeded the maximum standardization incentive achievable of \$340,000.

Because of the significant amount of savings which could be involved, the contractor decides on a case-by-case basis which make of equipment he will purchase. It is difficult for the contractor to consider the standardization incentive on a case-by-case basis since such incentives are presently based on the per cent of APL-supported equipment in each category. The contractor, therefore, tends to assess the question of standardization in terms of the gross incentive achievable as contrasted with the gross savings achievable if the equipments with the lowest acquisition price are selected. Insofar as the seven contracts with incentive clauses are concerned, it would appear that the "gross savings achievable" wins the contest. In other words, we believe each

shipbuilder is placing primary emphasis on selecting equipment with the lowest acquisition price and only secondary attention is given to selecting equipment already in the fleet.

LMI tried to determine the magnitude of dollars which would be involved if the contractor paid a premium for APL-supported equipment above the purchase price of the low-bid item in those cases where the low-bid item was non-APL supported. Unfortunately, data was not available to us to establish the magnitude of such savings to the contractor if he did not pay the premiums, or the cost to the contractor if he did pay them. We therefore had to be content with contractor estimates and past experience. Although contractors' estimates cannot be validated, it is nevertheless appropriate to consider them since it is on the basis of such estimates that several contractors have concluded that the amount of the standardization incentive is too small.

In any event, the gross savings to the contractor if he does not make a direct effort to select supported equipment may be approximated, based on one contractor's estimates. The contractor's cost to procure all HM&E equipment is approximately 30% of the contract price, so that for a \$10M ship some \$3M is involved. Approximately 75% of all HM&E equipment installed will be equipment which is already supported in the Navy and at the same time represents the low-bid items to the contractor. This leaves 25% of the equipment falling into the category of low-bid items but non-supported. If this equipment represents a proportionate ratio of the procurement dollar (\$3M per ship), then the contractor will spend some \$750K per ship ($25\% \times \$3M$) on equipment which is not currently supported in the Navy.¹ Now the contractor estimates

¹ Some of the non-supported equipment may be required due to unique ship specifications, but such equipment will be ignored here for the purpose of developing an approximation of contractor savings via selection of non-supported equipment.

that the purchase price of various makes of competing equipment will normally range from 10%-20% above the purchase price of the low-bid make. Thus the contractor might expect to pay on the average 15% more if he ignores the low-bid item and selects a make of equipment which is already supported. This would amount to an additional \$112,500 per ship set, in this case ($15\% \times \$750K$). Using this method, the contractor's savings, if he does not make a direct effort to select APL-supported equipment, can be approximated by multiplying the contract price by 0.01125 ($30\% \times 25\% \times 15\%$). Table 3 indicates what such approximations would amount to for each of the seven contracts and compares this to the maximum standardization incentive achievable. The approximations in Table 3 are based on the assumption that 75% of the equipments would be both low-bid and APL supported. This figure would probably be much higher for several of the contracts which followed previous contracts for the same class of ships by one year or less.

TABLE 3
APPROXIMATION OF CONTRACTOR COST TO ACHIEVE
100% HM&E APL-SUPPORTED EQUIPMENT

Ship Contracts	Maximum Standardization Incentive	Approximation of Contractor Cost Using Method Described
AS-37	\$200K	\$ 420K
AOR 3-4	200K	605K
SSN673-76	800K	1254K
LST-1182-98	340K	2802K
DE 1078-97	200K	2449K
AKA-117	100K	247K
LSD-40	200K	268K

d. Value Engineering Waivers. Paragraph (d) of each of the standardization incentive clauses contains a value engineering provision as follows:

"If the contractor considers that an item of equipment offers an order of magnitude technical advantage over an item supported by an APL in effect or pending on 1 January 1966, the contractor should submit a value engineering proposal under the value engineering incentive clause of the contract. A non-APL supported equipment will be deemed to be supported by an APL in effect or pending on 1 January 1966 if the use of such non-APL supported equipments is necessitated by approval and application of the value engineering proposal."

The above value engineering provision and the accompanying Value Engineering Incentive Clause provide an opportunity for the contractor to consider equipment standardization in terms of the overall economic benefits to the Navy within certain limitations. The main limitation is that in order to qualify for the Value Engineering Incentive, the VE proposal must result in a change order to the contract; i.e., a change in the drawings, designs, specifications, or other requirements of the contract. This limitation gives the contractor no incentive to apply life cycle cost analysis in the equipment selection process unless the item selected would somehow result in a change order to the contract.

We found no cases in the seven contracts to date where paragraph (d) of the Standardization Incentive Clause had been, or is planned to be, exercised; in fact, very few VE proposals of any kind have been submitted. Contractors cited several principal reasons for their reluctance to submit VE proposals: (1) small per cent of proposals accepted out of those submitted;¹ (2) excessive

¹ Some Navy personnel responsible for process Value Engineering Change Proposals (VECPs) state that rejection is often due not to technological or economic reasons but rather to the lack of available funds for VECPs or that no change order is required for implementation.

time to evaluate proposals; and (3) lack of common understanding and agreement as regards quantitative values of various cost elements.

3. Assessment of the Contribution

It is difficult to assess the contribution of the various Standardization Incentive clauses in terms of actual performance for two reasons. First, very little data has been submitted to date in accordance with the provisioning requirements of MIL-P-15137C. The September 1967 "Monthly Progress Report for Shipbuilding and Conversion" (NAVSHIPS 250-574) lists five of the seven contracts as having Allowance List zero percent complete. Second, and perhaps more significant, is the fact that there is no established benchmark from which to measure the contractor's performance at the present time other than a fleet-wide norm determined on the basis of current SPCC experience.

Based upon our discussions with the shipbuilders, we expect that four of the seven contracts (AKA 117, AOR 3-4, AS-37 and LSD-40) will result in 95% or more identically with components installed on previous ships of the same class built by the same contractor. This will not constitute a standardization achievement under the present incentive clause requirements, however, because many of the equipments on the previous ships were purchased after 1 January 1966, thus no APL was in effect or pending. Over 90% identically with APL-supported equipment as of 1 January 1966 is likely with respect to the SSN673-676 contract. With regard to the DE1078-97 and the LST1182-98 contracts, it is doubtful that the normal achievement of identically with APL-supported equipment will be significantly exceeded.

In conclusion, no concrete evidence was found that APL-supported equipment had been selected thus far in any of the contracts because of the standardization incentive.

In spite of this we believe the standardization incentive clauses have made a significant contribution. They have attracted shipbuilder management attention to the problems associated with poor equipment standardization in the Navy, and have stimulated management interest in exploring the profit potentials through increased standardization. Although each of the contractors visited indicated that the present clauses need clarification or modification of one type or another, there appears to be a general consensus that an incentive arrangement could be developed that would serve the best interest of the Navy and the contractor.

It is encouraging to note the recent efforts of one contractor in pursuing equipment standardization in his shipbuilding program for the Navy. This shipbuilder who has three of the seven contracts with standardization incentive clauses has developed a Standardization Plan which is now being implemented. The Plan outlines procedural requirements in the process of equipment selection and includes the development and use of a Preferred Items List. The plan is required for use by Division Engineers and Designers in all design tasks.

B. CONTRACTING FOR COMPONENT STANDARDIZATION

1. Primary Objectives

Much has been written recently on benefits associated with standardization of ship equipment. It is not the intent of this report to repeat what has already been described in other documents. It is only necessary to state four principal goals which we believe should be pursued in developing contractual requirements or incentives to achieve equipment standardization. These four goals are:

- (a) Minimize variety of equipments and repair parts at all levels, including intra-ship, intra-contract/class, and intra-Navy;
- (b) Maintain technological progress;
- (c) Maximize selection of preferred equipments within a group of available or existing equipments; and
- (d) Maintain price competition.

The present standardization incentive clauses are only partially responsive to these goals. They are zimed primarily at only intra-Navy standardization. They do make it possible to maintain technological progress but only in a restricted sense (see discussion on Value Engineering Waiver, page 15). They do not emphasize the selection of preferred components but rather the re-use of any APL-supported components prior to 1 January 1966. They do not directly impair price competition, but at the same time they do not provide any stimulus to price competition.

2. Incentive vs. Mandatory Requirements

The Navy has two basic routes by which to pursue the objective of achieving greater equipment standardization in new ship construction. The first is to impose mandatory contractual requirements on the shipbuilder. This approach would appear to be feasible and highly desirable insofar as Intra-Contract standardization is concerned.¹ In this case all equipments installed in the first ship of any given contract would be required to be installed in all other ships included in the same contract unless a specific waiver was approved by the Navy. Such a requirement would not run contrary to the contractor's normal equipment pro-

¹ The Navy is currently including Intra-Contract standardization requirements in new ship construction contracts.

curement practices. A mandatory requirement with respect to Intra-Contract standardization would cause a shipbuilder to give due consideration to his vendors' delivery capability as well as price.

The mandatory requirement, on the other hand, has many disadvantages when applied to other levels of standardization. Mandatory requirements at the Intra-Ship level are extremely difficult to impose since this would require that the Navy perform much of the detail systems engineering and subsequently develop such detail performance specifications as would be required to restrict the variety of equipment installed. Mandatory requirements at the Intra-Navy level could have several ill effects. If the requirement was to use any APL-supported equipment as of a particular date, technological progress would suffer, many inferior equipments currently in use would be perpetuated, and the Navy would most likely be subjected to an increased burden in evaluating requests for waivers. If the requirement was to use a more restricted list of equipment, the Navy would have the problems associated with the development of such a list, competition at the vendor level would be restricted, the cost of shipbuilding would undoubtedly increase, and the Navy would have to assume the entire responsibility for maintaining technological progress.

The alternate route by which standardization objectives may be pursued is to provide the shipbuilder with an incentive to achieve these objectives. We believe that this is by far the more effective route to take provided the incentive is properly structured. Equipment standardization is not always economically feasible; therefore, the incentive plan should be so structured as to motivate the contractor toward standardization only when there is an economic advantage to the Navy to do so. Thus, the amount of incentive offered the contractor is a key factor regard-

less of the level of standardization at which the incentive is aimed.

3. Determining Amount of Incentive

Three factors should be considered in determining the amount of incentive required to motivate the contractor to achieve equipment standardization in the best interest of the Navy: (1) the probable degree of standardization achieved without an incentive; (2) the cost to the contractor of exceeding the normal degree of standardization achieved; and (3) the economic advantage to the Navy of exceeding the normal degree of standardization achieved. The first two factors have already been discussed in previous sections of the report. Therefore, our discussion here will be limited to the third factor.

The economic advantage of equipment standardization to the Navy includes all of the elements of life cycle costs associated with the standard or preferred equipment. A significant element of life cycle cost with respect to standardization, and perhaps the easiest to measure, is supply management costs.¹ For example, two equipments, one standard and the other non-standard (not currently in the system), may have comparable values of life cycle costs (i.e., purchase price, operational costs, maintenance, documentation, training, etc.); but an economic advantage would nevertheless result by selecting the standard equipment in that the supply management costs would be less. It is therefore appropriate and expedient to consider the value of standardization to the Navy only in terms of supply management costs except in those cases where a significant difference is known or suspected to exist with respect to one or more of the other elements of life

¹See footnote (2), page 6.

cycle costs. Table 4 summarizes the areas of cost criteria for standardization consideration as applied to the standardization objectives discussed earlier.

TABLE 4

AREAS OF COST CRITERIA FOR STANDARDIZATION
CONSIDERATION AT VARIOUS LEVELS

Standardization Objectives	AREAS OF COST CRITERIA		
	Supply Costs @ Shipboard Level	Supply Mgmt. Costs @ Navy Supply Level	All other Elements of Life Cycle Cost
Intra-Ship	X	X	
Intra-Navy		X	
Preferred Equipment (including both eco- nomically and techno- logically preferred)	X	X	X

It will be noted in Table 4 that Supply Management Costs are considered at the Navy Supply level. Such costs have been given a great deal of attention recently and have been quantified by the Navy at \$100 per line item per year. At the shipboard level, we have considered Supply Costs in a broader sense, which may include among other things supply management costs aboard ship. Some Navy personnel have expressed doubts regarding the practicality of quantifying supply management costs at the shipboard level. They argue that reducing the number of line items carried aboard ship would probably not result in a reduction of shipboard supply personnel, and that any resultant space savings aboard ship would be

insignificant and difficult to measure in terms of dollars. While we generally agree with these arguments, it is recognized that there may be other areas of economic benefit associated with shipboard supply costs which are measurable, such as less investment costs in On Board Repair Parts (OBRPs). In addition, there may be other costs or readiness benefits which can be assigned an economic value and can be related to equipment or line item reductions aboard ship. In any event, further study would be required to develop such a value at shipboard level similar to the supply management cost per line item per year established at the Navy Supply level.

The Supply Management Cost at Navy Supply level may be expressed as follows:

$$\left(\begin{array}{l} \text{Supply mgmt.} \\ \text{cost @ Navy} \\ \text{Supply level} \\ \text{per new APL} \end{array} \right) = \left(\begin{array}{l} \text{Initial} \\ \text{cost of} \\ \text{prepar-} \\ \text{ing a} \\ \text{new APL} \end{array} \right) + \left(\begin{array}{l} \text{Average} \\ \text{no. of} \\ \text{new line} \\ \text{items} \\ \text{per new} \\ \text{APL} \end{array} \right) \left(\begin{array}{l} \text{Supply Mgmt.} \\ \text{cost @ Navy} \\ \text{supply} \\ \text{level per} \\ \text{line item} \\ \text{per year} \end{array} \right) \left(\begin{array}{l} \text{Number} \\ \text{years} \\ \text{consid-} \\ \text{ered} \end{array} \right)$$

The number of years over which the Supply Management cost should be considered for standardization purposes is, of course, a matter of judgment. The ship's life may range from 20 to 30 years. It does not seem prudent, however, to assess the value of standardization over so long a period of time, particularly for the purpose of establishing an incentive rate. There are too many uncertainties which might tend to alter the situation over 20 or 30 years. Equipments that are initially installed aboard ships may be replaced by different varieties during the life of a ship for a number of reasons, such as: the initial variety is no longer manufactured or cannot be delivered when required; the cost of the equipment or its repair parts becomes prohibitive; or, conversions

to the ship require different types of equipment. Equipments could be replaced any time during the ship's life when the equipment fails and is beyond repair, but in most cases replacement would occur at the time of scheduled overhaul. Most ships are normally overhauled every three years. It is fairly safe to assume that equipments requiring replacement at the first overhaul and any time up to the second overhaul would most likely be replaced by the same variety. Thus, it seems that five years would be a more reasonable time over which to consider the value of standardization for incentive purposes.

The Ships Parts Control Center, Mechanicsburg, has developed the following data:

- Initial cost of preparing a new APL = \$1000.
- Average number of new Federal Stock Numbers (FSNs) per new APL = 1.5. (Including the APL itself, the number of new line items per new APL would be 2.5.)
- Supply management cost at Navy Supply level per line item per year = \$100.

Thus, under the above conditions:

$$\left[\begin{array}{l} \text{Supply mgmt.} \\ \text{cost @ Navy} \\ \text{supply level} \\ \text{per new APL} \end{array} \right] = \left[(\$1000) + (2.5)(\$100)(5) \right] = \$2250$$

The supply cost at the shipboard level for any given number of ships built under a single contract may be expressed as follows:

$$\left(\begin{array}{l} \text{Supply cost} \\ \text{@ shipboard} \\ \text{level per} \\ \text{APL} \end{array} \right) = \left(\begin{array}{l} \text{Av.no. of} \\ \text{new line} \\ \text{items per} \\ \text{new APL} \end{array} \right) \left(\begin{array}{l} \text{Supply cost} \\ \text{@ shipboard} \\ \text{level per line} \\ \text{item per year} \\ \text{per ship} \end{array} \right) \left(\begin{array}{l} \text{Number} \\ \text{years} \\ \text{consider-} \\ \text{ered} \end{array} \right) \left(\begin{array}{l} \text{Number} \\ \text{ships in} \\ \text{contract} \end{array} \right)$$

Assume for illustrative purposes that the supply cost @ shipboard level is equal to \$20 per line item per year per ship. Then:

$$\left(\begin{array}{l} \text{Supply cost} \\ @ \text{ shipboard} \\ \text{level per} \\ \text{APL} \end{array} \right) = (2.5)(\$20)(5) \left(\begin{array}{l} \text{No. ships} \\ \text{in contract} \end{array} \right) = \$250 \left(\begin{array}{l} \text{No. ships} \\ \text{in contract} \end{array} \right)$$

The amount of incentive offered the contractor to achieve equipment standardization should be based on some sharing ratio applied to the Navy economic benefits resulting from the contractor's achievement beyond that degree of standardization he normally would achieve under a fixed-price contract. The added cost to the contractor to achieve a greater degree of standardization should be considered in determining the amount of incentive, and should also be considered in determining the net economic benefits to the Navy. The next section of the report presents a proposed Comprehensive Standardization Plan which incorporates these principles and is aimed at achieving the overall objectives of standardization as previously discussed.

C. A COMPREHENSIVE COMPONENT STANDARDIZATION PLAN

1. General Description of the Plan

This proposed standardization plan consists of a four-part program aimed at achieving the greatest degree of equipment standardization economically feasible during new ship construction. The plan has thus been structured around an attempt to provide an economic incentive to the contractor to achieve standardization only when such achievement results in a net economic advantage to the Navy. It is intended that the plan, if accepted, would be translated into appropriate contractual language and incorporated

in future ship construction contracts as a comprehensive Equipment Standardization Clause.

The plan is based on motivating the contractor to consider all of the aspects of equipment standardization to the greatest extent possible from the Navy's point of view. Underlying the plan is recognition that the contractor may have to incur additional costs in evaluating and implementing standardization actions in the best interest of the Navy. Except for Part 2 of the plan, participation is optional on the part of the contractor. It is intended that the economic incentive will provide sufficient motivation for the contractor to participate where standardization is economically feasible from the Navy point of view.

The four parts of the Standardization Plan are:

Part 1: Intra-Ship Standardization

Part 2: Intra-Contract Standardization

Part 3: Intra-Navy Standardization

Part 4: Lowest Life Cycle Cost Equipment Selection

Part 1 of the plan is aimed at achieving a minimum variety of equipments within a single ship. Part 2 is aimed at achieving maximum commonality of equipments among several ships built under a single contract. Part 3 is aimed at achieving maximum commonality with equipments already supported in the Navy where the economic advantage to do so results primarily from supply management savings. Finally, Part 4 is aimed at maintaining an optimum balance between technological progress and economy in the selection of equipments.

Part 4 describes an approach whereby life cycle cost analyses may be used to determine the economic advantage associated with the selection of a particular equipment where such equipment does not represent the lowest acquisition price to the shipbuilder. This part of the plan would be exercised under either one of two conditions: first, when the economic advantage associated with the selection of a particular equipment includes elements of life cycle cost other than supply management, such as maintenance, training or operational costs; and second, when it may be more economical to take advantage of advancements in marine equipment technology than to standardize to existing equipment. The approach includes a method for determining how a shipbuilder may be recompensed for installing a piece of equipment in the ships he is building which has a higher acquisition price than a competitive model, both of which meet minimum performance specifications, when it can be shown that the more expensive equipment will result in the lowest life cycle cost to the Navy.

Much remains to be done to perfect the use of life cycle cost analyses in the selection of ship components and equipment. It is necessary for the Navy to provide certain cost factors to the contractor (shipbuilder) if he is to make disciplined life cycle cost analyses. It is suggested that the Navy make a concerted effort to develop those cost factors so that Part 4 can be incorporated into standardization incentive clauses as quickly as possible. In fact, there is much to be said for using Part 4 even before all required cost factors for analyses can be agreed upon by the Government. Such early introduction would be justifiable because, as stated earlier in this report, the value engineering change provision in presently used standardization

incentive clauses doesn't completely provide for those instances where it is not economical, on the basis of total cost to the Navy, to standardize to existing equipment during new construction.

The contractor may receive an increase in the initial contract price under Part 1, Part 3, and Part 4. Part 1 is independent of Parts 3 or 4. Any equipment submitted under Part 4 of the plan, however, is not eligible to be counted under Part 3.

Each part of the plan is described in the following paragraphs accompanied by an illustration.

PART 1: Intra-Ship Standardization

Objective: Minimum variety of equipments within a single ship.

Approach: Profit-sharing incentive for contractor technical/economic analyses.

Method: A. Historical Data Base

1. Establish equipment quantity target from historical data (i.e., the number of APLs expected for the particular ship under contract).
2. Establish incentive rate per APL.
3. Check actual number of APLs installed and pay contractor at established rate for each APL below target.

or B. Competitive Bidding Base

1. Establish equipment quantity target from contractor's bid.
2. Establish standardization value per APL and incentive rate per APL.
3. Check actual number of APLs installed and pay contractor at established rate for each APL below target.

If alternative B is selected, the Navy must establish the standardization value per APL and the incentive rate prior to the solicitation of ship construction bids; and state in the Invitation for Bid (IFB) that the bids will be evaluated on the basis of the sum of the "fixed-price bid" plus the product of the equipment quantity target and the standardization value per APL. For example, suppose that Contractor X and Contractor Y bid \$50.0M and \$50.1M respectively on a five-ship construction contract as shown in Table 5. Suppose further that Contractor X states in his bid that he will have 2600 different equipments installed which require APLs, and Contractor Y states that he will have 2400. If the standardization value per APL is established at \$1800 per APL, then Contractor X will have \$4.68M added to his bid price. As illustrated in Table 5, the award would go to Contractor Y and his Equipment Quantity Target would be established at 2400. If Alternative B is selected, the contractor winning the award will be contractually bound to meet the Equipment Quantity Target he has quoted or incur a penalty equal to the amount per line item used to evaluate the proposal--in this case, \$1800.

TABLE 5

ILLUSTRATION OF COMPETITIVE BIDDING BASE FOR
INTRA-SHIP STANDARDIZATION INCENTIVE

Contractor	Fixed Price Bid	Equipment Quantity Target	Standardization Value per APL	Amount Added to Bid Price	Contractors' Price for Bid Evaluation Purposes
X	\$50.0M	2600	\$1800	\$4.68M	\$54.68M
Y	\$50.1M	2400	\$1800	\$4.32M	\$54.42M

Navy Inputs:

- Selection of Alternate Method
- Establish Equipment Quantity Target (if alternate method A is selected)
- Establish Incentive Rate

Contractor Qualification Requirements:

APLs installed must be less than target quantity to qualify for incentives.

Contractor Incentive:

$$\left(\begin{matrix} \text{Incentive} \\ \text{Amount} \end{matrix} \right) = \left(\begin{matrix} \text{No. of} \\ \text{APLs below} \\ \text{target} \end{matrix} \right) \left[\$281 + \$125 \left(\begin{matrix} \text{No. of} \\ \text{ships in} \\ \text{contract} \end{matrix} \right) \right]$$

IncentiveRationale:

Contractor receives 50% of the economic benefits accruable to the Navy over the first five years of ship's life resulting from reduced supply management cost at Navy Supply level and reduced supply costs at shipboard level.

$$\left(\begin{array}{c} \text{Incentive} \\ \text{Amount} \end{array} \right) = \left(\begin{array}{c} \text{Sharing} \\ \text{Ratio} \end{array} \right) \left[\left(\begin{array}{c} \text{Probable} \\ \text{no. of} \\ \text{new APLs} \\ \text{avoided} \end{array} \right) \left(\begin{array}{c} \text{Supply} \\ \text{mgt. cost} \\ \text{at Navy} \\ \text{supply} \\ \text{level per} \\ \text{new APL} \end{array} \right) + \left(\begin{array}{c} \text{No. of} \\ \text{APLs} \\ \text{below} \\ \text{target} \end{array} \right) \left(\begin{array}{c} \text{Supply} \\ \text{Cost at} \\ \text{shipbd.} \\ \text{lev. per} \\ \text{new APL} \end{array} \right) \right]$$

Substituting for the sharing ratio (50%), for the supply management costs at Navy Supply level, and for the supply costs at shipboard level developed on pages 23 and 24:

$$\left(\begin{array}{c} \text{Incentive} \\ \text{Amount} \end{array} \right) = .5 \left[\left(\begin{array}{c} \text{Probable} \\ \text{no. of} \\ \text{new APLs} \\ \text{avoided} \end{array} \right) \left(\begin{array}{c} \$2250 \end{array} \right) + \left(\begin{array}{c} \text{No. of} \\ \text{APLs} \\ \text{below} \\ \text{target} \end{array} \right) \left(\begin{array}{c} \$250 \end{array} \right) \left(\begin{array}{c} \text{No. of} \\ \text{ships} \\ \text{in con-} \\ \text{tract} \end{array} \right) \right]$$

It has been established that normally 75% of the APLs generated in new construction are already in the Navy supply system (see pages 7 and 8). We suggest that this factor be refined for different types of ships contracted for under several different situations. (See discussion, page 8.) However, for illustrative purposes we will use the 75% in developing the incentive amount. Therefore, if the number of APLs installed aboard a new ship is reduced, only 25% of these are likely to have been new APLs. Therefore, the following approximations may be made:

$$\left(\begin{array}{c} \text{Probable no. of} \\ \text{new APLs avoided} \end{array} \right) = .25 \left(\begin{array}{c} \text{Number of APLs} \\ \text{below target} \end{array} \right)$$

Now, making this substitution and simplifying the equation:

$$\begin{pmatrix} \text{Incentive} \\ \text{Amount} \end{pmatrix} = \begin{pmatrix} \text{No. APLs} \\ \text{below} \\ \text{target} \end{pmatrix} \left[\$281 + \$125 \begin{pmatrix} \text{No. of} \\ \text{ships in} \\ \text{contract} \end{pmatrix} \right]$$

Navy

Benefits: Five years after construction - Equal to incentive amount paid

Ten years after construction - Three times the incentive paid

Illustration:

Number of ships in contract - 20

APL target - 2400

Number of distinct APLs installed in 1st ship - 2300

Number of APLs below target - 100

$$\begin{pmatrix} \text{Contractor} \\ \text{Incentive} \\ \text{Amount} \end{pmatrix} = (100) \left[\$281 + \$125(20) \right]$$

$$\begin{pmatrix} \text{Contractor} \\ \text{Incentive} \\ \text{Amount} \end{pmatrix} = \$278,100$$

PART 2: Intra-Contract Standardization

Objective: Maximum commonality of equipments among ships built under a single contract.

Approach: Contractual requirement for all equipments installed in each ship built under the contract to be identical to equipments installed in the first ship of the contract.

PART 3: Intra-Navy Standardization

Objective: Maximum commonality with equipments already supported in the Navy.

Approach: Profit Sharing Incentive.

Method:

1. Establish minimum equipment commonality ratio normally achieved among equipments installed in new construction and equipments already supported in the Navy.
2. Establish incentive rate per equipment appropriate for intra-Navy standardization.
3. Check actual number of APLs installed in the first ship of the contract which are already supported in the Navy and pay contractor at established rate for each APL above minimum when commonality ratio is applied.

Navy Inputs:

1. Minimum equipment commonality ratio.
2. Incentive rate.

ContractorQualificationRequirements:

The number of APLs installed in the first ship of the contract which are already supported in the Navy must be greater than the established minimum.

Contractor Incentive:

$$\left(\begin{array}{c} \text{Incentive} \\ \text{Amount} \end{array} \right) = \left[\begin{array}{c} \text{No. of APLs} \\ \text{installed in} \\ \text{first ship} \\ \text{of contract} \\ \text{which are} \\ \text{already} \\ \text{supported} \end{array} \right] - 75\% \left[\begin{array}{c} \text{Total} \\ \text{number} \\ \text{of APLs} \\ \text{installed} \\ \text{in first} \\ \text{ship} \end{array} \right] \left(\begin{array}{c} \$1125 \end{array} \right)$$

Incentive Rationale:

Contractor receives 50% of the economic benefits accruable to the Navy over the first five years of ship's life resulting from reduced supply management cost at Navy Supply level.

$$\begin{pmatrix} \text{Incentive} \\ \text{Amount} \end{pmatrix} = \begin{pmatrix} \text{Sharing} \\ \text{ratio} \end{pmatrix} \begin{pmatrix} \text{Probable} \\ \text{no. of} \\ \text{new APLs} \\ \text{avoided} \end{pmatrix} \begin{pmatrix} \text{Supply mgmt.} \\ \text{cost at Navy} \\ \text{supply level} \\ \text{per new APL} \end{pmatrix}$$

Substituting for the sharing ratio (50%) and for the supply management cost at Navy Supply level developed on page 23:

$$\begin{pmatrix} \text{Incentive} \\ \text{Amount} \end{pmatrix} = \begin{pmatrix} .5 \end{pmatrix} \begin{pmatrix} \text{Probable} \\ \text{no. of} \\ \text{new APLs} \\ \text{avoided} \end{pmatrix} \begin{pmatrix} \$2250 \end{pmatrix}$$

The probable number of new APLs avoided will be the difference between the number of APL-supported equipments achieved and the number which probably would have been achieved without the incentive. The number achieved without an incentive is on the average 75% of the total number of APLs installed. This figure might be different under different circumstances (see pages 7 and 8). However, assuming a 75% normal commonality ratio, the amount of incentive is:

$$\begin{pmatrix} \text{Incentive} \\ \text{Amount} \end{pmatrix} = \left[\begin{pmatrix} \text{No. of APLs} \\ \text{installed} \\ \text{in first} \\ \text{ship of con-} \\ \text{tract which} \\ \text{are already} \\ \text{APL-supported} \end{pmatrix} - 75\% \begin{pmatrix} \text{Total} \\ \text{no. of} \\ \text{APLs in-} \\ \text{stalled} \\ \text{in first} \\ \text{ship} \end{pmatrix} \right] \begin{pmatrix} \$1125 \end{pmatrix}$$

NavyBenefits:

Five years after construction - Equal to incentive amount paid

Ten years after construction - Three times incentive amount paid

Illustration: Total number of APLs installed in first ship - 2300

Number of APL-supported equipment achieved - 2000

$$\begin{pmatrix} \text{Contractor} \\ \text{Incentive} \\ \text{Amount} \end{pmatrix} = \left[(2000) - (.75)(2300) \right] (\$1125)$$

$$\begin{pmatrix} \text{Contractor} \\ \text{Incentive} \\ \text{Amount} \end{pmatrix} = \$309,375$$

PART 4: Lowest Life Cycle Cost Selection

Objective:

Maintain optimum balance between technological progress and economy in the selection of HM&E equipments.

Approach:

Profit Sharing incentive for contractor lowest life cycle cost analyses.

Method:

1. Contractor develops a plan for applying lowest life cycle cost analysis in the selection of HM&E equipments.
2. Navy reviews contractor's plan and approves or rejects.
3. Navy establishes quantitative values for those elements of life cycle cost which will be used in the analysis and for which Navy is responsible (e.g., supply management cost).

4. Contractor applies life cycle cost analysis in accordance with approved plan and submits for incentive fee in cases where lowest life cycle cost component is not the component with the lowest purchase price.

Note: All components considered must meet minimum performance specifications.

5. Navy exercises option to accept or reject contractor's proposal to install lowest life cycle cost component.
6. If Navy rejects contractor's proposal, contractor may procure component having lowest purchase price.
7. If Navy accepts contractor's proposal, contractor procures component having the lowest life cycle cost and Navy pays contractor an incentive fee.

Navy Inputs:

1. Analysis of contractor plan.
2. Quantitative values of pertinent life cycle cost elements.
3. Review of contractor's analysis for each component submitted.

Contractor Qualification Requirements:

1. Approved plan for analysis.
2. Adequate demonstration for each component submitted.

Contractor Incentive:

$$\begin{aligned}
 \text{Incentive Amount} &= \left(\text{Difference in purchase price to contractor} \right) + 50\% \left(\text{Diff. in life cycle cost to Navy over 5 years excluding purchase price} \right) - \left(\text{Diff. in purchase price to contractor} \right)
 \end{aligned}$$

Incentive
Rationale:

Contractor is reimbursed for the additional cost to procure the component having the lowest life cycle cost over the component having the lowest bid purchase price; and in addition receives 50% of the net economic benefits accruable to the Navy over the first five years of ship's life resulting from selected elements of life cycle cost.

$$\left(\begin{array}{l} \text{Contractor incentive} \\ \text{amount per component} \\ \text{proposed and accepted} \end{array} \right) = (P_2 - P_1) + 50\% \left[(x_1 - x_2) - (P_2 - P_1) \right]$$

where P_1 = purchase price of component having lowest bid purchase price

x_1 = life cycle cost over 5 years for component (1) excluding purchase price

P_2 = purchase price of component having lowest life cycle cost.

x_2 = life cycle cost over 5 years for component (2) excluding purchase price

Navy
Benefits:

Five years after construction - Equal to incentive amount paid

Ten years after construction - Three times incentive amount paid

III. CONCLUSIONS AND RECOMMENDATIONS

Summary of Conclusions

1. The Equipment Standardization Incentive clauses examined are not likely to result in a significant increase in the degree of standardization achieved in each respective contract over the degree which probably would have been achieved without the incentives.
2. The Equipment Standardization Incentive clauses have made a significant contribution in attracting management interest in dealing more effectively with the problems of standardization, and this interest should be nurtured by developing incentives which more realistically relate contractor achievement to Navy benefits.
3. Except for Intra-Contract standardization, the contractor incentive approach to achieve Equipment Standardization is a more feasible and effective approach than applying mandatory requirements.
4. The present Equipment Standardization Incentive clauses require modification in at least three areas to effectively achieve the goals of equipment standardization which are:
 - (1) a wider scope of interest including intra-ship standardization and preferred component selections; (2) an incentive measurement base that relates to total degree of standardization achieved rather than to the smallest degree achieved of several selected categories; and (3) an incentive rate more directly related to Navy benefits.

5. An average supply cost per line item at the shipboard level by appropriate ship classification or by total fleet should be established for the purpose of making standardization or other economic analyses.
6. An Equipment Commonality ratio normally achieved without standardization incentives should be established for various types of ships under several conditions, and subsequently used as a base from which contractor standardization incentives may be applied.

Recommendations

1. It is recommended that future ship construction contracts include a comprehensive standardization clause which contains both a mandatory requirement and optional incentive provisions for achieving component standardization in accordance with the standardization plan proposed in this report.
2. It is recommended that the Navy initiate an indoctrination program for the purpose of explaining the new standardization clauses and soliciting management support from the shipbuilding industry.

APPENDIX A

THE "EQUIPMENT STANDARDIZATION INCENTIVE" CLAUSE AS STATED IN P.R. 529-61403, AMENDMENT 3, FOR THE LST 1180 CLASS

ARTICLE 17. EQUIPMENT STANDARDIZATION INCENTIVE--(a) The objective of this Article is to increase maintainability of shipboard equipment and reduce cost of logistic support by encouraging installation in the vessel of equipments identical to those already installed in U. S. Navy ships and for which Allowance Parts Lists (APL) have already been prepared or are pending. An APL is a standardized list of parts developed by the Department of the Navy for specific components which are installed aboard Naval ships as discussed in Section 9310-1 of the Ship Specification.

(b) To encourage meeting the objectives of paragraph (a) above, the contract price shall be increased, as provided in paragraph (c), if at least 90% of the Contractor furnished equipments comprising each of the following categories are supported by APLs in effect or pending on 1 January 1966 or by APLs obtained from use of the equipment on the LST 1179.

<u>Category</u>	<u>First 2 Digits of APL Number</u>
Pumps	01
Boilers	02
Heat Exchangers	03
Condensers	04
Compressors	06
Heaters	07
Distilling Plants	08
Circuit Breakers (over 100 amp trip)	14
Controllers and starters, motor (for 1/2 H.P. motors and larger)	15 & 34
Generators	16
Motors (1/2 H.P. and larger)	17
Motor-generators	18
Gyro Compass	25
Refrigeration equipment and air conditioning equipment	32 & 33
Fans (except bracket fans)	40

<u>Category (continued)</u>	<u>First 2 Digits of APL Number</u>
Galley and Commissary, Laundry Equipment	43 & 91
Capstans, Cranes, Winches, Windlasses,	
Ammunition Hoists	52, 53, 57, 62 & 63
Steering Gears	60
Propulsion Controls	61
Engines, Diesel	66
Gear Assemblies and Shaft Coupling	
(10 H.P. and larger)	69 & 78
Propellers, controlled pitch	83, 52, 85, & 61
Clutches, propulsion	83, 52, & 61
Valves (ferrous - 2" and over)	
(non-ferrous - 4" and over)	88

The percentage for each equipment category listed above shall be computed by using only those equipments in the category that have been assigned an APL number, the first two digits of which are shown above adjacent to such category. To arrive at such percentage, the number of contractor-furnished equipments of such category supported by APLs in effect or pending on 1 January 1966 or by APLs obtained from use of the equipment on the LST 1179, plus any items of such category covered by paragraph (d), below, shall be divided by the total number of contractor-furnished equipments in the same category without regard to the date of issuance or pendency of the related APL, and the quotient multiplied by 100 and rounded off to the nearest full percent (a percentage so arrived at that ends in .50 shall be considered as the next higher full percent).

(c) Subsequent to receiving the Coordinated Shipboard Allowance List (COSAL) for the vessel, and prior to final settlement, the Contractor shall submit to the Contracting Officer a list of all items comprising each equipment category set forth in paragraph (b) above, indicating the items the Contractor considers had APLs in effect or pending on 1 January 1966 or by APLs obtained from use of the equipment on the LST 1179, and the percent relation arrived at as provided in paragraph (b) above. The Contracting Officer shall determine the percentage for each equipment category. The contract price shall be adjusted, by the amount, set forth below, corresponding to the highest percentage, set forth below, that equals the lowest percentage achieved by any equipment category of the vessel, as determined by the Supervisor of Shipbuilding:

<u>Lowest % of Contractor-Furnished APL Supported Equipments in Any Category</u>	<u>Price Increase Per Vessel</u>
90%	10,000
91	10,500
92	11,100
93	11,800
94	12,600
95	13,500
96	14,500
97	15,700
98	17,000
99	18,400
100	20,000

The decision of the Contracting Officer as to computation and amount of contract price adjustment under this Article shall be final and shall not be subject to the Disputes Clause of the contract.

(d) If the Contractor considers that an item of equipment offers an order of magnitude technical advantage over an item supported by an APL in effect or pending on 1 January 1966, or by APLs obtained from use of the equipment on the LST 1179, the Contractor should submit a value engineering proposal under the value engineering incentive clause of this contract. A non-APL supported equipment will be deemed to be supported by an APL in effect or pending on 1 January 1966 if the use of such non-APL supported equipment is necessitated by approval and application of the value engineering proposal.

(e) Nothing in this Article in any way relieves the Contractor from fully complying with the requirements of the specifications.

APPENDIX B

42

ASSISTANT SECRETARY OF DEFENSE
Washington 25, D. C.

Installations and Logistics

DATE: 9 May 1967

TASK ORDER SD-271-71
(TASK 67-18)

1. Pursuant to Articles I and III of the Department of Defense Contract No. SD-271 with the Logistics Management Institute, the Institute is requested to undertake the following task:

A. TITLE: Incentives for Achieving Component Standardization in Ship Construction

B. SCOPE OF WORK: Standardization Incentive Clauses have been incorporated in several recent ship construction contracts. The purpose of such incentives is to obtain optimum standardization. This task will appraise the effectiveness of the incentive clauses toward achievement of improved standardization of Hull Mechanical/Electrical equipment. In addition, the feasibility of establishing uniform criteria for determining standardization incentives will be examined. The study effort will include:

(1) Consideration of the rationale which led to the specific standardization incentive clauses incorporated in each existing contract.

(2) Assessment of the contribution of the incentive clauses to increased shipbuilder motivation to design and build standardized ships.

(3) Recommendations for uniform criteria for establishing maximum/minimum dollar incentives required to motivate shipbuilders to standardize on ship components in the overall best interest of the Government.

(4) Recommendations as to possible modifications to the presently used incentive clauses to provide improved overall benefits.

2. SCHEDULE: A progress briefing will be provided on or about 15 July. A final report will be submitted by 15 September 1967.

/S/ Paul R. Ignatius

ACCEPTED /S/ Barry J. Shillito

DA'D May 9, 1967